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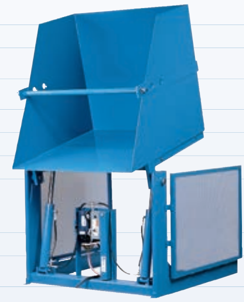

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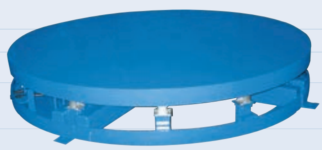

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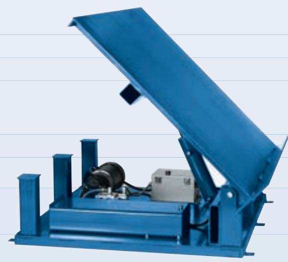

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FEATURE

How To Select The Right Belt for Package and Handling Applications

Variables for manufacturers to consider include speed, friction, and environmental conditions

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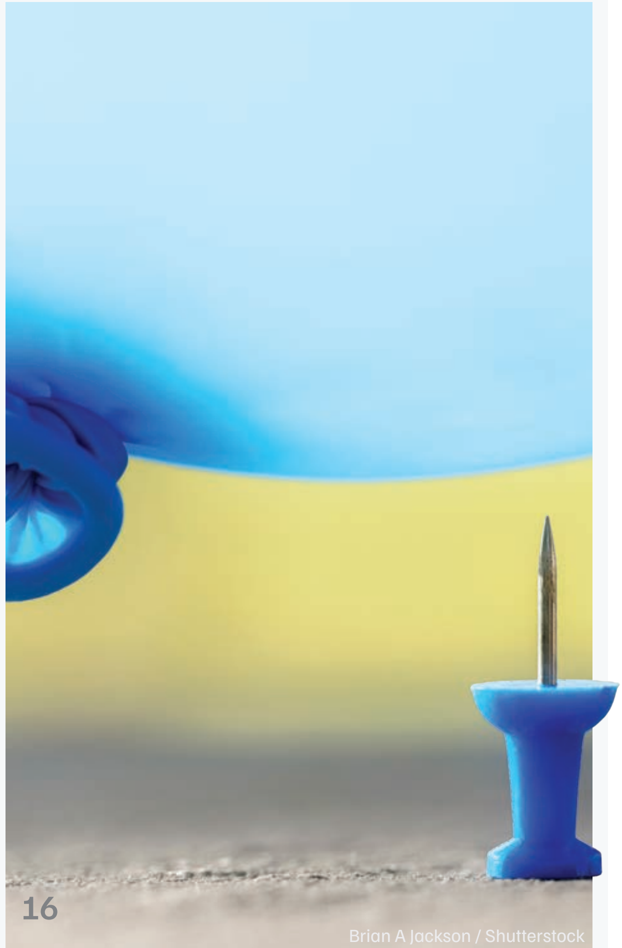

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Achieve & Protect Compressed Air System Efficiency

Take these five actions to reduce plant operating costs and preserve hard-won gains

COLUMNS

AD INDEX

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THOMAS WILK

From the Editor

PdM vs. INFLATION

A series of tough reports were released in July, touching on new job creation and consumer spending sentiment. The U.S. Bureau of Labor Statistics revised job gains in May and June sharply downward by 258,000, with only 73,000 jobs added to the economy in July. Inflation also picked up again in July and is up to 2.9%, which is above the Fed's 2% target, and almost 90% of adults in the U.S. say they are stressed about grocery prices.

But inflation is not only impacting the price of eggs. This summer I came across a fascinating research report from Siemens titled "True Cost of Downtime 2024" that tracks how the cost of unplanned downtime in U.S. industry has risen over the past five years. From the report:

- **U.S. price inflation has totaled 19% over 2019-23.**
- **The cost of an hour's downtime has risen by 113% in the automotive sector ($2.3 million / hour).**
- **The cost of an hour's downtime has risen by 319% in heavy industry.**

However, there also is some very good news in the report for those in industry who have been fighting unplanned downtime with every tool at their disposal: average hourly plant downtime across all sectors is down by nearly a third since 2019!

- **Major manufacturers suffer 25 downtime incidents a month per facility on average, down from 42.**
- **They lose 27 hours per plant per month, down from 39.**
- **In automotive and heavy industry, hours lost to unplanned downtime have halved over the past five years.**

Ironically, the report found that fewer companies are citing predictive maintenance as a strategic priority – because PdM has become business as usual in fighting unplanned downtime, as "nine out of 10 manufacturers we surveyed collect at least some data that gives them a view of machine health."

Take a look at the Siemens report for yourself, for the morale boost as much as anything. PM and PdM best practices are helping organizations offset significant cost pressure from inflation. Remember that the next time someone says that the M&R function is more of a cost center than a profit driver. Δ

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JOE KUHN

Leadership in Action

HOW A MISDIAGNOSED BEARING EXPOSED BEST PRACTICE GAPS

Failures may be a symptom of a larger problem: the prevailing maintenance culture

Earlier this year I received an email from a very upset maintenance manager (let's call him John). A maintenance technician's misdiagnosis led to a significant equipment failure event at the plant. The case involved a bearing failure on a conveyor that was diagnosed as "it's the chain, not the bearing."

This misdiagnosis resulted in a snapped shaft, eight hours of unplanned downtime, and a lot of angry people. John was getting yelled at by both the plant manager and production manager. The entire maintenance organization had a black eye. John was embarrassed. He was considering issuing discipline to the technician for poor job performance, and reached out to me for my thoughts on how to react to the event.

While the damage was limited to time and material, the bigger story lies in how such events are managed, and more importantly, how organizations learn and grow from them. I see this as a textbook example of the difference between reactive and proactive leadership in the world of reliability and maintenance.

At face value, the failure was simple: A bearing was misdiagnosed as functional when it was, in fact, failing. The incorrect diagnosis by two technicians led to a catastrophic shaft failure. In hindsight, the bearing was likely emitting clear signals: audible noise(s), a temperature increase, an ultrasonic anomaly, and/or increased vibration – all indicating impending failure. These were either missed, dismissed, or never measured.

This event should prompt an immediate technical debrief. What was seen, heard, felt, and smelled? Has this failure happened before? Were condition-based maintenance tools available, such as infrared thermography (IR), ultrasound, or vibration analysis? If so, were they used? If not, why? Was it a lack of access, training, or initiative? Were the technicians in a rush or under other pressures?

These are the fundamental reliability questions that determine whether the failure was due to system flaws or personnel performance. It is easy to cast blame in the wake of failure, but blame is a poor substitute for root cause analysis. The true failure here was not the bearing alone; it was a failure of culture.

HOW MAINTENANCE CULTURE IMPACTS ASSET RELIABILITY

The incident exposed a deeper issue: the prevailing maintenance culture. The technician's comment, "It's the chain, not the bearing," was not just a technical misstep; it was a cultural symptom. Was this diagnosis the result of guesswork, convenience, or a real analysis? Was there a structured troubleshooting protocol? Was the technician given time to do troubleshooting? Were there pressures to rush the assessment? Had this technician ever been held accountable or trained to validate such assumptions with data? Was this just the way things have always been done?

This leads to a critical leadership question: Is the organization truly committed to a reliability culture, or is it stuck in a reactive, run-to-failure mode? If the latter, then expecting precision and accountability from technicians without investing in the right systems and training is both unfair and unsustainable.

Technicians are only as good as the system they work within. If their job

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has been reduced to keeping things moving and "getting by," then errors like this are inevitable. If they are expected to be professionals – diagnosing and solving root causes – they need the tools, training, time, and support to do so.

LEADING THROUGH MAINTENANCE FAILURES WITH COACHING AND ACCOUNTABILITY

John's gut response was "I want to tear them a new one," and it's an understandable reaction. Downtime is expensive. Failure is frustrating and embarrassing. But emotional responses often make poor long-term strategies. The objective should not be to punish, but to correct and improve. The real challenge is to convert a failure event into a coaching opportunity – coaching that will make us better tomorrow than today. Before jumping to conclusions, every leader should ask, "Are these employees worth saving? Are they good people who made a bad call, or are they warm bodies filling a schedule?" If they are salvageable, and especially if they have potential, the best course of action is to develop them. Here is a structured process to approach this situation:

- **Debrief with purpose – Gather the involved technicians and walk through the failure. Ask open-ended questions about their decision-making process. Use 5-Whys to dive deep into their thought process.**
- **Require reflection – Ask each technician to send an email outlining what they learned and what they would do differently next time. This encourages personal accountability and growth without public shame.**
- **Turn failure into ownership – Consider making the involved technicians the site's new "rotating equipment" champions. Have them research bearing failure modes and present new practices to prevent failures and propose predictive tools to find problems very early. Use the event to build expertise, not destroy morale.**
- **Coach up or coach out – If a technician is not coachable, does not care, or continually under-performs, then it is time for a hard decision. But coaching should always be the first step.**
- **Institutionalize the learning – Update your maintenance procedures or inspection protocols. If this happened once, it can happen again. Make it a team learning moment, not just an individual one.**

Reliability is not simply achieved by installing better equipment and parts. It's most often achieved by installing better culture: across teams, across departments, and across leadership. Equipment fails. But when people fail to learn, grow and change from those failures, that is a leadership failure. This event is a mirror showing the weaknesses of your team and your maintenance culture. I told John on Monday to get the maintenance leadership team together to ask these hard questions:

- **Do we have a proactive maintenance culture or a reactive one?**
- **Do our technicians have the tools and training they need?**
- **Are we holding people accountable in a way that also helps them grow?**
- **Are we using failures as opportunities to build a stronger team and culture of reliability?**

If we want proactive, data-driven technicians, we need proactive, data-driven leaders. I call this a culture of reliability. In the end, the broken shaft is just steel. The real value is in how you respond and whether your team and culture are stronger or weaker because of it. ∆

SPONSORED CONTENT

Industry Perspective

Ryan Smith is a Solutions Engineer with TPC, a Certus company, whose areas of training specialty include industrial maintenance topics for electrical, mechanical, and HVAC systems. For more information on TPC visit: b2b.tpctraining.com/perspective.

WHAT IS THE ROI OF TRAINING?

There's a direct connection between the bottom line and the time & money you invest in your teams

In times of business uncertainty, training can be the first of the budget items people look at when they make cuts. Part of the reason for this is the challenge that plants face to calculate a hard ROI on the value of training, and tie training investments directly to plant profitability. In this interview, Ryan Smith answers the question, ***How do you calculate the ROI of training?***

PS What plant KPIs are you aware of that are often tied directly back into training programs?

RS On its face, training feels like an expenditure only, like a cost center more than a cost savings, where companies are just dedicating dollars into it and not sure whether they're getting the payback. Thankfully, in the world of training, the benefits do improve so many parts of the business that can be quantified.

The first one has to do with reduced downtime. We ask our customers: ***How many minutes of downtime do you have per day, or per week or per month?*** And then: ***Can you tell us how much money it costs your company for each hour of downtime on a given machine in your facility?***

They report tens of thousands of dollars minimum per hour of downtime, and that's typically *per machine*.

If you think about the confidence of what it takes to (a) figure out what's wrong with the machine; (b) identify the root cause; and (c) make the repair and get it back up and running, that takes a level of skill and knowledge that all speaks back to training.

Really, that whole process is all part of what we call *troubleshooting skills*. It's a big area that we focus on: how to build troubleshooting knowledge and how the confidence in those skills can be detected through reduced machine downtime.

Even increasing uptime a couple percentage points over the course of a year, where there's millions of dollars at stake, provides an immediate return on your training program (and then some) because of improved confidence in troubleshooting.

PS Beyond downtime, what would you say some of the other key metrics are that you can tie the value of training back to?

RS The reduced safety incident rate is the most quantifiable. How many near misses or full-on OSHA recordable incidents are happening in your facility every year? Maybe you had just one in the last year, maybe you had a few. How much are those safety incidents really costing the company, first and foremost?

And there is another cost associated with safety incidents: workers' compensation costs. The company is now liable for clinic visits and rehabilitation costs. But it all comes back to: was this person properly trained to do the job? And were they trained to do that job in a way that meets the standards of your organization?

But it's not just about workers' comp, right? There are associated OSHA fines. Anytime you have to record an injury or incident to OSHA, those come with five figures, easily, of OSHA violations and fines that can stack.

Another metric to look at is the DART rate – the Days Away, Restricted, and Transferred from the job. This rate impacts the effectiveness of the workforce and the ability to schedule people in that workforce.

And that all bleeds through to the bottom line of that company, as well, because now we have to add more temporary labor, which is less reliable. Or we have to overschedule people—let's say those working 12-hour shifts now have to start working 15-hour shifts to cover the people who are away. This means team members may make more mistakes due to fatigue.

PS Can you give us some insight into these processes: the calculation of ROI values. and then the strategies or importance of reporting them out to various levels of the organization?

RS Creating a kind of a metabolism, a culture and a process around continuing to track and monitor them around these KPIs is really where a learning management system, or LMS, can come into play. The operations team is tracking downtime, usually on an hourly and daily basis. You can go into your learning management system and see, for example, a 3% improvement in downtime, from 87% uptime to 90% uptime.

Next, go back to the LMS for that same date range and see which trainings were completed at which times. And how folks did on their pre- and post-tests or their simulation assessments—where they're troubleshooting actual relays, VFDs, and electric motors? Is that tying back, over time, to downtime improvement?

An LMS also solves another challenge that pen-and-paper tracking causes. It's hard to find any trends or ways training tied back operations when you rely on handwritten records. It doesn't mean anything once it's in a filing cabinet. If OSHA knocks at your door, you've got to let them in. They're going to ask you all sorts of questions, and one of the first questions any OSHA inspector asks is: *"Where's your records of training? Which training have you offered, and when did you offer it? And is there proof of completion of that training?"*

If it's all handwritten, you're starting to look through your cabinet and may be panicking a little bit. But when it's in an LMS instead of a file cabinet, it's available immediately through your digital paper trail — utilize the LMS to pull your records in a few clicks. It uses the exact date range and shows you who completed training, when it was completed, and how they scored on knowledge checks.

TPC
A CERTUS COMPANY

Increasing uptime a couple of percentage points over one year provides an immediate return on your training program.

Plus, information is transferred between the decision makers in your plant much quicker thanks to cloud-based storage. Everyone who's on that management team or administering training within that plant or the larger organization can see those results, immediately after training is complete.

PS You mentioned a couple different kinds of training, especially the value of hands-on training. These mobile tools have lent themselves to a rise in simulated learning as well. I was curious to know if there are areas of knowledge delivery that lend themselves to simulated learning?

RS I would say the world of electrical troubleshooting training lends itself very well to simulated learning, for a couple of reasons.

The first reason is: when you troubleshoot live electrical equipment in the field, it's great hands-on learning, that's true. But it's also very dangerous, and very *instantly* dangerous if you do something wrong. You can go from everything being fine to being seriously life-threateningly shocked or experiencing an arc flash injury in a matter of a split second. That could send you to the hospital if you're not properly trained and not following proper procedures.

What if there was a way for folks to have that experience of opening a live electrical panel and making their mistakes without getting hurt or destroying million-dollar equipment? There really is a large appetite for simulated electrical learning, because you can create those issues and practice repairing them without causing serious damage to equipment.

PS I've heard a lot of chatter this year, 2025, about teams wanting to focus on process improvement due to business uncertainty introduced in the marketplace in Q2. What are you hearing from your customers in this regard?

RS We're getting a lot of requests for things like programmable logic controller (PLC) training, and variable frequency drive training—very electronics-based training.

But then—and I think this speaks to that uncertainty—we're seeing companies having to cope with the fact that they're hiring some brand-new, very green technicians into their workforce out of necessity. They need to lean on the promise of someone's potential more than their experience level in the matter.

When this happens, they need a system or a program in place to get inexperienced team members ramped up quickly. There's huge value in getting right down to brass tacks and having a structured way of giving those green people a chance to *learn into* their roles. And when employers provide training programs with simulations, people can have a nice, lucrative career for themselves – all driven by that good training program. ∆

SHEILA KENNEDY

Technology Toolbox

FLUID HANDLING DEVELOPMENTS MAKE WAVES

Innovative technologies and systems target reliability, efficiency, and predictability

Better ways to manage, measure, and control the use of oil and industrial fluids have early adopters reaping the benefits. Fluid handling and flow instrumentation solutions such as flowmeters, storage and transfer systems, and pumps are increasingly connected and digitalized, more feature laden, and raise the standard for monitoring and optimization.

CONNECTIVITY GAINS

Working toward a fully digitalized instrumentation and network-centric architecture, ABB announced that its SwirlMaster and VortexMaster flowmeters were awarded FieldComm Group Ethernet-APL certification. The communication interface enables remote access to measurement values, process data, and meter information from flowmeters that was hidden or inaccessible in the past, says Frank Frenzel, global product line manager at ABB.

"At ABB, we have implemented APL to the highest cybersecurity standards. We have also made a great effort to ensure maximum compatibility, and we are very proud that FieldComm Group confirmed and certified this compatibility," adds Frenzel.

The Pulse Asset system for fluid management from Graco is designed for facilities with varying wireless signal availability. Its programmable ID tags meter and track fluid dispenses, even when offline. Up to 40 dispenses can be stored for later syncing with Graco's Pulse HUB when a connection is available, ensuring access to the data needed to predict machinery failure and help manufacturers increase asset uptime.

"When seals in machinery begin to wear out, fluid consumption rates increase. Though other systems may attempt to track these consumption rates, many of the dispenses go unrecorded, resulting in unusable data. Pulse Asset automates the recording of data," explains Graco Product Manager Jack Koenig. "A secondary benefit is that it helps prevent the dispense of the wrong fluid into a reservoir."

TECHNOLOGY ADVANCEMENTS

Improved instrumentation and handling solutions deliver results. The HM-U Hydraulic System Flow Meter from AW-Lake is a turbine flowmeter that measures the flow rates of hydraulic fluids for components such as pipes, valves, and fittings. Monitoring, regulating, and controlling flow rates helps its users to optimize maintenance and performance of the hydraulic equipment.

Mounting an AW-Lake Edge Flow Sensor with Bluetooth on an HM-U turbine flowmeter further improves access, control, and understanding of the flow measurement. From a mobile device, operators can remotely configure, assign parameters to, adjust, and troubleshoot the sensor.

LubriSource Fluid Handling (LSFH) systems for industrial fluid storage and dispensing save retrieval time, handling costs, and floor space compared to drum and pump alternatives. The product segment, purchased from IFH Group (formerly Sauk Valley Equipment Company), complements LubriSource's suite of industrial lubrication equipment and services. New fire-safety kits are among the latest improvements to the LSFH product line.

LSFH solutions "ensure customers store lubricants safely while also preserving oil through proper identification, filtration, and breathers," says Angela Morrow, president of LubriSource. "The most recent enhancement provides measurement at each dispense, allowing a company to accurately measure all fluids and enabling proper inventory controls, condition monitoring, and cost savings."

Sheila Kennedy, CMRP, is a professional freelance writer specializing in industrial and technical topics. She established Additive Communications in 2003 to serve software, technology, and service providers in industry. She can be reached at *sheila@addcomm.com* or *www.linkedin.com/in/kennedysheila.*

VIDEO REFERENCES

LubePM
↗ https://www.youtube.com/watch?v=p1ZSrPUbSvY

STD Ultrasound Solutions
↗ https://www.youtube.com/watch?v=mp_jDhpqKQU

PUMP DEVELOPMENTS

Multi-feature pumps and pumping systems are getting attention. The PERIPRO Tube Pump from NETZSCH Pumps USA provides a precise, reliable, and low-maintenance alternative to more complex dosing systems. The peristaltic pump is designed for continuous operation and its only wearing part is the tube. Being hermetically sealed and having an integrated leak sensor helps to prevent contamination.

"With no unnecessary electronics, the pump is a cost-effective solution for accurately metering a broad range of chemicals and additives. It's the perfect choice for low-flow, low-pressure, industrial applications," observes Michael Tardiff, mining market and PERIPRO product line manager at NETZSCH Pumps USA.

The new MLE pump motor series from Grundfos is distinctive for its power output of up to 30 horsepower (hp), integrated Safe Torque Off (STO) function that mitigates risks of exposure, standard built-in Modbus RTU, Bluetooth connectivity for improved communication, and an Ethernet port to facilitate Cloud and Grundfos GO Link access for certain models.

Referring to its reliability and energy efficiency for a wide range of applications, Brendan Watson, senior technical sales manager at Grundfos, believes the MLE motor represents a "significant leap forward" in pump technology.

An expanded range of Design Envelope Permanent Magnet pumps from Armstrong Fluid Technology is engineered to deliver significant reductions to energy consumption. "Design innovations including permanent magnet motor technology, improved hydraulics, and intelligent, connected variable speed control make these new Design Envelope pumps more energy efficient and cost effective," says David Lee, offering manager at Armstrong Fluid Technology. ∆

DOC PALMER
Palmer's Planning Corner

HOW ORGANIZATIONAL THEORY INFORMS MANUFACTURING RELIABILITY

Move from chaos to coordination by applying Mintzberg's organizational models

With great respect and reference to Henry Mintzberg and his 1983 work ***Structure in Fives: Designing Effective Organizations***, this article applies his technical names for organizational structures and concepts to our maintenance teams. Mintzberg's work unlocked the door for me to get planning "working." It led to my Maintenance Planning and Scheduling Handbook, McGraw-Hill's continuing best-selling reliability book.

Organizations of all types are good at specializing, but poor at coordinating. Coordination glues together the efforts of the specialized functions, and Mintzberg defines five primary coordination mechanisms available for teams to use. Using the correct primary coordinating type makes the organization stable (effective and enduring). Using the incorrect primary coordination makes the organization unstable (ineffective and soon to fail). Unfortunately, most companies around the world have a significant reorganization every five years. And again, they reorganize...

Our *primary* coordination mechanism for maintenance should be having skilled professionals, and not rules. Here's an example from the movies: after having a "chat" with the captain, the captured damsel of The Pirates of the Caribbean ghost ship demands she be released in accordance with the 'Code of the Pirates' which declares: "No hostages are taken during a parley." The ghost ship captain patiently explains "The 'Code of the Pirates' are not so much as *rules* as they are *guidelines*, and you are not going anywhere!" So, while having plans and procedures, maintenance craftspersons must also exercise their judgment.

Doc Palmer, PE, MBA, CMRP is the author of McGraw-Hill's Maintenance Planning and Scheduling Handbook and is managing partner of Richard Palmer and Associates. For more information including currently scheduled workshops, visit *www.palmerplanning.com* or email Doc at *docpalmer@palmerplanning.com*. Also visit and subscribe to ww.YouTube.com/@docpalmerplanning

HOW TO ALIGN COORDINATING TYPE WITH INDIVIDUAL TEAMS

The proper form of an organization, along with the proper coordinating type, depends on the complexity and rate of change of both the technology and environment of the business. Smaller groups within a larger group may even need different organization types with matching coordinating types.

One organizational form is called an **adhocracy** and the proper coordinating type is **mutual adjustment**. A small group in normal operation or any size group in a crisis coordinates with each other in *frequent meetings*, always touching base with everyone.

Another form, a group with "low" technology in a rapidly changing environment, operates best as a **simple form** organization with a **direct supervision** type of coordination: "Do this... Now do that." Everyone is continually *attentive to the boss*.

A group with "higher" technology with a low rate of technology change and low rate of environmental change operates best as a **machine bureaucracy**. The proper matching coordinating type is rules (**standardization of work processes**). A key part of the organization is the rule makers (the **technostructure**). Think of an automobile assembly line: The rule makers have established *exactly* what each worker does on the line.

A group with higher technology with a higher rate of change and also a high rate of environmental change operates best as a **professional bureaucracy** form. The proper coordinating type is *staffing*: emphasizing hiring and training for skills (**standardization of skills**). A key part of the organization is the persons actually doing the work (the **operating core**). Think of doctors, always exercising their judgment and skill with different patients having new problems along with changing medical treatments. Another key part here is the **support staff** which performs functions such as payroll or accounting designed to keep the operating core busy applying its expertise.

Finally, a larger group over a large area or many functions operates best as a **divisional form**. The proper coordinating type is *metrics* or key process indicators (KPIs) (**standardization of outputs**). Think of a company with several plants: "What was the MTBF of the Jacksonville plant? What was the profitability of the Atlanta store?"

WHICH TYPE IS BEST FOR MY MAINTENANCE TEAM?

The closest organizational match for maintenance teams is "professional bureaucracy," so our primary coordinating type should be staffing. Maintenance has fairly complex technology that is changing, but not at a crisis rate. The environment also changes continually, but also not always in crisis. Maintenance performs different tasks on different days, some routine but many requiring on the spot judgment.

Therefore, to have the most stable (most effective and enduring) maintenance effort, we should primarily emphasize hiring, training, and retention of skilled craftspersons. (Note: this is not to say we do not want great plans and procedures. Rather we want craftspersons to make judgments during execution and contribute to betterment of plans and procedures.)

Accordingly, planners and schedulers fall into the key area of support staff to provide the skilled craftspersons with work request triage (work scoping and plan head starts), craft historian help (for different assets with plans that grow better over time), and weekly backlog research (to bundle together the best selection of work) for supervisors. And this support staff of planners and schedulers is also best coordinated with staffing. Pay particular attention to having planners and schedulers with superior communication and organizing skills. Craft skills are also a plus for street credibility.

The best maintenance groups operate as a professional bureaucracy. They give top attention to hiring and training for craftspersons. They encourage them to leverage their skills and judgments during work execution. They also staff the planning and scheduling group with skilled persons to support the craftspersons. Don't settle for good. Be great! Turn those pirates loose! Δ

WHAT TO DO WHEN MAINTENANCE METRICS MISLEAD

KPIs may look impressive, but only floor-level audits reveal whether true reliability is being achieved

I walked into the maintenance shop and was immediately impressed. The floor shone, the shared tools were in labeled lockers, and everything from the cabinets to the whiteboards screamed "order." It was the kind of place you'd put in a job recruiting brochure.

But as I always say, "The truth is in the details." When I crossed the shop door boundary into the different production areas, the façade of a proactive maintenance group began to unravel.

The first red flag? Bearings and other components show signs of improper greasing. I spotted fittings where two—sometimes three—different colors of grease were clumped on the same zerk fitting. Mind you, this was a food plant where food-grade grease is required. Worse yet, grease was seeping past bearing seals. So much for the pride in maintenance ownership.

When asked about the metrics, the maintenance manager smiled and said, "We regularly hit 90% schedule compliance." I returned the smile, but later dug a little deeper and found that they were only scheduling about 28% of their maintenance labor force. What about the rest of the team? I came to learn they are floating in a sea of reactive chaos.

To be clear, if you only schedule a quarter of your workforce, then achieving 90% schedule compliance is essentially gaming the system: it's not a genuine win. Yet unknowingly, leadership touts the metric as a success story. Have you ever noticed that the metrics always seem to increase, but actual plant performance often doesn't match?

A dry-erase board sat above the kitting area. The last kit listed was from February. It was now June. It turns out that the kitting was another round of smoke and mirrors to game the system. This time, it was for the "Best Plant" award within the corporation. Once the auditors left and the award was secured, kitting was abandoned. The façade had served its purpose.

The site shared a trend averaging 97% PM compliance for months on end, on paper. Supervisors in a meeting later shared that they consistently exceed the corporation's 95% target. The harsh reality was that they were merely checking boxes, rather than preventing or reducing equipment failures. The equipment continued to fail. The PMs didn't address the likely failure modes. No one was asking: "Are we doing the right work, or just doing work to meet the metric?"

The planners hadn't been trained. They leaned heavily on tribal knowledge, which had been passed down, rather than the best practices approach. The published schedule listed corrective work and PMs for the next down day, but on the floor, it was just a list. No work packages. No prioritization. No clear instructions, only memory to guide them. Technicians assigned themselves to jobs.

In the storeroom, the manager shared that they strived to be "the epitome of customer service." Yet, common parts were scattered across distant rows, often 50 yards or more apart. The naming of the parts was chaotic. Technicians had to cross-reference another site's inventory to find a part.

Operators were understandably frustrated. The blame game was rampant. Maintenance was quick to point the finger at "operator error." No one talked about the lack of standard work from the maintenance side. There were no visual checks, no clear guidance on equipment specifications, and no shared accountability. Remember that 70–84% of failures are self-induced, often from careless work habits.

I know many of you can share similar stories from your experiences. This isn't about one plant. It's about a pattern. Too often, senior leaders and

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corporate teams look at dashboard KPIs and assume all is well. Metrics look great, awards are sometimes handed out, and no one bothers to ask the more profound questions, especially when the plant performance doesn't meet expectations.

Do you achieve high PM compliance, but are still experiencing failures? Dig deeper. When failures occur, the first question should be "Do we understand the root cause?" Then, physically verify that the corrective actions have been implemented. Create a culture that refuses to tolerate repetitive failures.

Do you have high schedule compliance? Contrast payroll hours against scheduled hours to determine the labor utilization.

Do you think you have a well-managed storeroom? Request to review the most recent cycle counts. Come in on the off-shifts and observe how long it takes for technicians to locate parts.

LEADERS DIG DEEPER TO FIX THE SYSTEM

Authentic leadership digs deeper, demands the truth, even when it's uncomfortable. To tear down façades, start by doing the following:

- **Ensure that the metrics match the true behaviors. Field audits can be very telling and allow you to educate the team in the process.**
- **Validate that the PMs address the likely failure modes. I prefer that the technicians own the PM program, and that they get trained on effective PM optimization techniques. Not only do ineffective PMs cause poor equipment performance, but they also waste maintenance resources.**
- **Train your planners and follow up with several weeks of coaching at a minimum. I like to see competency scoring leveraged for development.**
- **Use the schedule to set expectations, with labor hours, priorities, and sequencing based on all of the available labor, not a fraction. A work schedule is more than a listing of items to hopefully complete.**
- **Use kitting as a tool to address avoidable delays in work execution, which impedes improved wrench times. If nothing else, kitting gives the technicians a head start.**
- **The storeroom is a critical partner for maintenance success. Fix the naming conventions across the enterprise. Group common items. Reduce travel and waiting-time waste.**
- **Build a partnership with operations and other stakeholders to share accountability. Remember, reliability is not a matter of maintenance solely, nor will you achieve it by playing the blame game. Review failures together and own the solutions as a team.**

It's past time to get real with driving improved asset reliability. If you're in a leadership role and the metrics on your screen look too good to be true, they probably are. Recognize that the actual downtime cost is greater than ever, so even if your numbers are a few points higher, you are still in the same position. Don't fall for the shine if the system underneath is broken.

Here's my challenge to you—step beyond the façade. Question the numbers. Go to Gemba and walk the floor. Talk to the people doing the work. Then fix what matters.

Here's my challenge to you–step beyond the façade. Question the numbers. Go to Gemba and walk the floor. Talk to the people doing the work. Then fix what matters.

And if you're not sure where to start? Reach out. We've helped hundreds of plants rebuild from the inside out, and we can help you do the same. ∆

Written by

Ron Marshall
Marshall Compressed
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ASK THE EXPERTS: HOW TO ACHIEVE & PROTECT COMPRESSED AIR SYSTEM EFFICIENCY

Take these five actions to reduce plant operating costs and preserve hard-won gains

In this Ask the Experts feature, which runs regularly in Plant Services, expert instructors from the Compressed Air Challenge (CAC) tackle questions on compressed air systems and associated technology.

The Compressed Air Challenge, an educational foundation administered by the Compressed Air & Gas Institute, is a voluntary collaboration of industrial end-users; manufacturers, distributors, and their associations; trade organizations; consultants; state research and development agencies; energy efficiency organizations; and utilities. The CAC has one purpose in mind—helping facilities enjoy the benefits of improved performance of your compressed air system.

This month's question: **What would your compressed air improvement advice be to a plant manager faced with business uncertainty and shrinking budgets? Can you suggest the top compressed air improvement actions they should take to reduce their operating costs?**

1. REDUCING LEAKS AND MISUSE

Ron Marshall (Winnipeg, MB, L1&2 Trainer): Leaks can waste 20 to 40 percent of compressed air in unmanaged systems. Simple methods like soap bubble testing or using a basic ultrasonic leak detector can uncover major losses. Engaging operators in spotting leaks during regular rounds is also effective and free.

Paul Shaw (Berlin, CT, L1&2 Trainer): A major opportunity lies in identifying and fixing air leaks. Leaks can consume a significant amount of a system's output, and in poorly maintained systems, even more. Using an ultrasonic leak detector to audit your system—especially the last 30 feet of hose drops and tool connections—can uncover hidden losses.

Detection is just the start; fixing the leaks is what delivers savings. Making leak detection and repair a scheduled maintenance task can keep systems running efficiently and reduce energy waste by up to 50%.

Also, eliminating inappropriate uses of compressed air, such as using it for sweeping, cooling, or part ejection, can lead to substantial reductions in demand. These applications are often better served by electric fans, blowers, or other alternatives. A plant-wide usage audit can highlight where compressed air is being misapplied. Combined with training staff to recognize and avoid wasteful practices, this strategy can cut demand by 5-15% or more.

Paul Maguire (Natick MA, L1 Trainer): I often recommend as a first step to eliminate air leaks, which account for significant compressed air loss in many facilities. A leak detection and repair (LDAR) program using ultrasonic leak detectors can recover thousands of dollars in wasted energy annually.

2. LOWERING SYSTEM PRESSURE

Ron Marshall: Lowering system pressure is another easy win. Many systems run 10-20 psi higher than needed, and reducing pressure by just 2 psi can cut energy use by 1%. A quick pressure mapping exercise helps identify how low you can go without affecting performance. And reducing pressure also reduces leaks, about 1% less flow for every 1 psi in pressure reduction.

Paul Shaw: One of the quickest wins is to lower system pressure. To do this safely, first assess the pressure needs of your equipment, then reduce compressor setpoints in small steps while watching for performance issues. Clearing up restrictions like clogged filters or undersized piping ensures you can reduce pressure without causing problems. Many plants save 3-10% of their compressor energy costs this way with even greater savings possible if a lightly loaded compressor can be turned off entirely.

Paul Maguire: Lowering pressure from 110 to 100 psi could save up to $10,000 per year in a mid-sized plant. Consider this as a primary step to save costs.

3. TRAINING AND WORKFORCE EDUCATION

Ron Marshall: Staff training offers a strong return. The Compressed Air Challenge's Fundamentals and Advanced seminars teach practical, energy-saving strategies. A well-trained team avoids mistakes like overusing backup compressors or misusing air. The training also supports professional growth through CAGI certification pathways. (Register at www.compressedairchallenge.org/training.)

Kyle Peltier (Rock Hill, SC, L1 Trainer): Train your staff. No one is going to realize something is off if they do not know what they are looking at, and they don't know what they don't know until they take a little formal training. Consider having several people from your maintenance team, operations team, and management take at least a basic compressed air systems class such as the Compressed Air Challenge level 1 course.

4. SYSTEM MEASUREMENT, AUDITS, AND CONTROLS

Kyle Peltier: Without a doubt if the plant is not measuring power to each compressor, air flow from the compressor room, and pressure at multiple points across the plant that should be implemented immediately! It is very inexpensive and can quickly highlight areas of concern that can be improved to save on operating expenses.

Let's be honest, there are very few true compressed air system experts out there, and odds are none of them have reviewed your specific plant. A full compressed air system audit can not only save you money by highlighting adjustments that reduce compressed air waste, but can also be used in many cases to get rebates from power companies to support updates and upgrades to your system to reduce power consumption.

Jan Hoetzel (Grand Rapids, MI, L1 Trainer): Three proven steps can quickly reduce costs: First, gather real-time performance data to simulate system behavior under optimized control—revealing exactly where energy is lost. Second, improve the demand side by fixing leaks, trimming pressure, and reducing artificial demand—often cutting usage by 10-30% with minimal investment. Finally, install a smart master controller to automatically manage compressor operation based on real-time demand, stabilizing pressure while minimizing runtime and energy waste.

While these steps bring immediate operational benefits, their long-term financial impact is even more compelling. Smart control systems typically pay for themselves within 12-18 months, but a deeper analysis using Net Present Value (NPV) shows the real return. By projecting energy and maintenance savings over a 10-15 year period, NPV turns a short-term expense into a long-term asset, boosting profitability and operational stability for years to come. Unlike major mechanical overhauls, these control-layer improvements enhance existing infrastructure, lower total cost of ownership, and scale with your needs.

Paul Maguire: One final recommendation, consider upgrading to variable speed drive (VSD) compressors if you need a new compressor. These systems adjust output based on real-time demand, offering energy savings of 25-35% compared to fixed-speed units. To guide and justify these improvements, data monitoring tools like flowmeters and pressure sensors can help managers identify inefficiencies and calculate ROI, turning compressed air from a hidden cost into a strategic opportunity.

Juan Londono (Winnipeg, MB, L1 Trainer): Configuring the air compressors control to match the system's demand profile efficiently will substantially reduce the energy consumption by minimizing unloaded run time, preventing simultaneous operation of multiple compressors at partial load, and ensuring that the most energy efficient compressor is loaded or prioritized in the control chain.

Ron Marshall: Consider having an auditor take a close look at your compressor controls. Quite often built in energy management features are not activated and could save thousands of dollars in unloaded compressor run time. Commonly the auto feature of compressors is not activated, resulting in wasted energy consumption.

5. HEAT RECOVERY

Ron Marshall: Recovering heat from industrial air compressors offers significant financial benefits by turning wasted energy into usable heat. Since up to 90% of the electrical energy used by a compressor is converted into heat, capturing and reusing this energy—for space heating, water heating, or process heat—can substantially reduce fuel or electricity costs. Facilities that implement heat recovery systems often see a fast return on investment, with some achieving full payback in under a year. This not only lowers utility bills but also improves overall energy efficiency and supports sustainability goals.

Do you want help in finding out what to do to reduce your system's operating costs? The contact information of the featured experts in this article can be found at: www.compressedairchallenge.org/instructors.

HOW TO SELECT THE RIGHT BELT FOR PACKAGE AND HANDLING APPLICATIONS

Written by
Kevin McCarthy
Motion Conveyance Solutions

In the world of modern logistics, packaging, and material handling, choosing the right conveyor belt can make all the difference between hitting your KPIs or facing unplanned downtime.

Selecting the right conveyor belt for a specific package and handling application may seem straightforward. However, it actually requires a clear understanding of your operational needs, the characteristics of the products transported, and the availability of belt types and materials. A misstep can lead to excessive downtime, product damage, increased maintenance costs and energy use, and overall inefficiency. To avoid such setbacks, businesses must take a strategic and informed approach to belt selection.

WHERE TO BEGIN?

The starting point for choosing the right conveyor belt is understanding your application's specific demands. Not all package-handling systems are created equal. Some operations deal with fragile, lightweight parcels, while others are tasked with moving heavy, irregularly shaped loads. Some systems are designed for high-speed sorting, while others require precise product placement or stop-and-go motions that can cause extreme stress on the conveyor belt.

Each option imposes different demands on the belt. For instance, belts in a high-speed sortation system must offer excellent tracking, wear resistance, and minimal friction, while belts used in incline or decline conveyors require a high-friction surface or cleats to prevent packages from slipping.

Once the operational needs are defined, the next step is to review the nature of the products being conveyed. Understanding their size, weight, shape, and bottom-surface texture is critical. Lightweight items often require a low-tension belt to reduce power consumption and mechanical stress on the conveyor. Conversely, heavy packages demand a more robust belt with high tensile strength and tear resistance.

Package size affects the minimum pulley diameter and belt flexibility requirements. Sharp or abrasive package edges require tougher belt covers to withstand wear and impact without fraying or delaminating. Meanwhile, products with uneven bottoms or rigid protrusions might need a belt with a more rigid structure or a customized cover profile.

The type of packaging material is another factor that influences belt selection. Packages made from plastic, metal, cardboard, or shrink wrap all interact differently with conveyor belts. For example, slick shrink-wrapped parcels are prone to sliding, especially on inclines or in accumulation zones. In such cases, a belt with a higher coefficient of friction or a patterned surface may be necessary to keep products securely in place. On the other hand, cardboard boxes may gather dust or debris, which can reduce traction or build up in the system. This calls for belts that are resistant to contamination buildup or have easy-to-clean surfaces.

MATERIALS, DESIGN, AND ENVIRONMENTAL CONDITIONS

The belt construction, comprising both the carcass and cover materials, must be carefully chosen to match operational requirements. The carcass, or inner layer, provides strength and flexibility and is usually made from fabrics like polyester, nylon, or aramid. Polyester is popular for its low stretch and good dimensional stability, while nylon offers higher impact resistance and flexibility.

The cover layer, the belt's outermost surface and the one in contact with packages, can be made from materials such as PVC, urethane, silicone, or rubber. Each has its pros and cons. PVC is cost-effective and versatile but may crack from extreme cold. Urethane offers better resistance to abrasion and chemicals.

Surface texture also plays a key role in belt performance. Smooth belts are ideal for accumulation and easy product transfer, while textured or patterned belts improve grip and are better suited for inclines or declines (see **Figure 1**). Some belts feature coatings or profiles specifically designed for unique applications, such as longitudinal ribs to channel liquids away or perforations to allow airflow for drying or cooling. If your conveyor requires accumulation zones, then belt surface tension and release characteristics must be finely tuned to ensure smooth movement without product scuffing or jamming.

As industries evolve, sustainability is becoming a higher priority in material handling systems. Conveyor belts made from recyclable materials, or those offering long service life and low energy consumption, are gaining traction. Certain lightweight belts reduce motor loads, while belts designed for low-friction operation help minimize environmental impact. Some manufacturers now offer belts with ecologically friendly components.

Conveyor system design factors must also be considered during belt selection. These include pulley diameter, belt length and width, the number of drives and idlers, belt speed, and the type of take-up system. Smaller pulleys require more flexible belts, while wider belts must maintain lateral stiffness to prevent sagging or edge curling. Belt tension must be matched with the drive system to avoid slippage or excessive wear.

For curved conveyors or systems with multiple transition points, the belt must exhibit excellent tracking and sidewall integrity to stay aligned and centered. In high-speed applications, centrifugal forces become important variables that require precision-engineered materials and configurations.

Environmental conditions are equally important and must not be underestimated. Factors such as temperature, humidity, and exposure to oils, grease, moisture, or chemicals can drastically affect a belt's performance and longevity. In cold storage facilities, for example, belts must remain flexible and functional at subzero temperatures. In hot environments, especially those involving heat shrink tunnels or ovens, belts must withstand elevated temperatures without warping or degrading. Facilities exposed to water or high humidity levels require belts with hydrolysis-resistant materials and microbial resistance to prevent mold or mildew growth. For environments exposed to oils or solvents, chemically resistant belt materials like polyurethane or nitrile may be necessary to avoid swelling or deterioration.

In highly automated facilities or those that use robotic integration, the interaction between the belt and other equipment becomes even more critical. Belts in these environments must provide consistent product orientation and predictable movement to allow for precise robotic pick-and-place operations. Any variation in belt surface texture, speed, or flatness can result in misalignment or missed cycles. Belt tracking, stiffness, and minimal stretch are top priorities here. Furthermore, static buildup can interfere with sensors or create safety hazards, which means antistatic belts may be necessary.

FIGURE 1. This large distribution center's applications require merge, elevated, and incline belting. (Image courtesy of Motion.)

WHAT ARE SOME ESSENTIAL COST CONSIDERATIONS?

Maintenance requirements and total cost of ownership (TCO) are unfortunately often overlooked during the belt selection process, but they are critical to long-term success. A low-cost belt may initially seem appealing but can incur higher operational costs due to frequent replacements, increased downtime, or higher energy usage. Conversely, investing in a more durable, easy-to-clean belt often yields a lower TCO over time.

Belt changeover time, availability of replacement parts, and ease of sanitation and compatibility with existing conveyor infrastructure should all factor into the decision-making process. It's wise to work with a trusted belting supplier or system integrator who understands your industry's nuances and can offer customized solutions or modifications to standard belts.

Ultimately, selecting the correct conveyor belt for a package and handling application is not a one-size-fits-all decision. It requires a comprehensive assessment of the conveyed products, operating environment, system design, and performance expectations. ∆

THE CAPTAIN

Captain Unreliability

BLAME MAINTENANCE!

Discover all of the complexities faced by maintenance, and why none of it is really their fault

Ah, the maintenance department—those unsung heroes of industry who somehow find themselves wearing more hats than anyone else in the plant. They fix, they patch, they perform miracles with duct tape and baling wire, yet they are the first ones under fire when things go wrong. Because, naturally, every machine breakdown and every missed production target can be traced back to maintenance. After all, isn't it their fault the equipment wasn't built to withstand the operator's unique "interpretation" of procedure, or the design quirks of our stellar engineering team?

Let's start with operator training—or, as it's sometimes known, the "creative chaos" approach. Why waste time and resources on comprehensive training when we can simply give operators a brief introduction to the machine and call it a day? Surely, they'll figure it out on their own, and when they don't, maintenance will be right there to pick up the pieces (literally). Who could forget the classic scenario of an operator confusing the "Emergency Stop" button with "Do Not Touch Unless Absolutely Necessary," or running a machine in a way that the original manual explicitly warned against? But if it breaks, don't worry—maintenance should have prevented this by...well, somehow.

Now, let's talk about engineering design—the gift that keeps on giving. Who needs practical, field-tested designs when you can have sleek, theoretical innovations that look good in a CAD model? And if the machine happens to require a maintenance team of contortionists just to reach a critical bolt, or a complete teardown just to replace a tiny gasket, well, that's just "part of the challenge." Because, clearly, it's maintenance's job to adapt to engineering's unyielding genius.

And when a piece of equipment inevitably succumbs to fatigue under the weight of its design flaws, who's to blame? Why, maintenance, of course! They should have anticipated the stresses and strains caused by the latest engineering masterpiece. So what if the design makes it nearly impossible to maintain without a custom tool kit and a Ph.D. in quantum mechanics? It's maintenance's fault for not having the "foresight" to keep this gleaming paragon of inefficiency running flawlessly.

One of the best parts of this whole setup is the eternal "fix it faster" mantra. The equipment goes down, and all eyes turn to maintenance. But there's always a fun twist: the time and resources they might need to do proper repairs? Limited or, better yet, non-existent. "Why are we spending so much on parts?" management will ask, as they pressure maintenance to work with whatever remnants they can salvage from the scrap bin.

And, oh, the ingenuity of corporate accountability. When production grinds to a halt due to a mixture of undertrained operators and convoluted design choices, who gets to take the fall? Not the engineers—they're too busy moving on to their next "groundbreaking" design. Not the operators—they're simply "following protocol." No, the blame lands squarely on the maintenance team's shoulders. Clearly, they should have been mind-readers, psychologists, and mechanical wizards, all at once.

In the world of modern manufacturing, maintenance is the universal scapegoat. After all, someone has to be responsible for the equipment not being "idiot-proof" enough to survive the daily gauntlet of creative misuse, and it certainly won't be the folks designing or operating it. Maintenance exists to catch those falling anvils, to fix the unfixable, and to be held accountable for the lapses of others.

Cheers to the maintenance heroes, the unsung fixers of everyone else's follies! ∆

Captain Unreliability is a satire of the state of manufacturing in 'Merica, USA, by an industry professional known for using humor to get the point across. Email him at *Captain.Unreliability@ReliabilityX.com*, or follow him on Twitter: @CUnreliability.

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